Chapter 46

Tutoring Process in Emotionally Intelligent Tutoring Systems

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ABSTRACT

Research has shown that emotions can influence learning in situations when students have to analyze, reason, make conclusions, apply acquired knowledge, answer questions, solve tasks, and provide explanations. A number of research groups inspired by the close relationship between emotions and learning have been working to develop emotionally intelligent tutoring systems. Despite the research carried out so far, a problem how to adapt tutoring not only to a student's knowledge state but also to his/her emotional state has been disregarded. The paper aims to examine to what extent the tutoring process and tutoring strategies are adapted to students' emotional and knowledge states in these systems. It also presents a study on how to influence student's emotions looking from the pedagogical point of view and provides general guidelines for selection of tutoring strategies to influence and regulate student's emotions.

INTRODUCTION

Recent research in psychology, neuroscience, pedagogy, and cognitive science has shown that emotions play a key role in the learning process, understanding of a problem domain, decision making, and motivation (Ahn & Picard, 2005). Traditionally, emotions have been viewed as a source of motivational energy but they have not been often regarded as an independent factor in learning or motivation (D'Mello et al., 2005). Intelligent tutoring systems (ITS) of the latest generation should be able to influence students' emotions in similar way as human-teachers affect them in order to improve students' learning abilities. Research on the emotional impact on the learning process has proposed a new concept related to intelligent tutoring systems – an Emotionally Intelligent Tutoring System (EITS) (Ochs & Frasson, 2004a). These systems are capable to act as traditional ITSs and to implement all components of the

learning process (choose the way to present teaching material, adapt teaching pace to student's learning abilities, give hints during solving of tasks, provide appropriate feedback after tasks and knowledge assessment, and modify content, amount, and complexity of teaching material) and also to adapt them to an emotional state of the student and to show its own emotions; thus, reacting to student's actions in the environment. Developing such tutoring systems, particular attention should be paid to the adaptation of tutoring process and tutoring strategies taking into account not only the student's current knowledge state but also his/her learning style and emotional state.

The paper presents a study on how emotions influence the learning process and students' learning abilities as well as it examines the current state of EITSs development putting greater emphasis on tutoring process and tutoring strategies. The paper also describes how to influence student's emotions during the learning process to keep them in the desirable state by changing behavior of the tutoring system looking from the pedagogical point of view. A deep literature study was conducted in order to explore the evolution of ITSs into EITSs and to summarize previous research on adaptation of tutoring in EITSs as well as to develop general guidelines for selection of tutoring strategies to influence and regulate student's emotions.

INTELLIGENT TUTORING SYSTEMS

ITSs are adaptive computer systems, which are based on the theory of learning and cognition. ITS-based learning process is very similar to the process when a student and a tutor interact in a one-to-one situation, therefore, an effective intelligent tutoring should simulate what good human-tutors do when implementing individualized instruction. The key feature of ITSs is their ability to adapt presentation of teaching material to a particular student by using methods of artificial intelligence (AI) to make pedagogical decisions and to represent information about each student.

Such systems allow implementation of a more natural learning process by adapting a learning environment (content, feedback, navigation, etc.) to characteristics of a particular student. Adaptation is possible because of a student diagnosis module that collects and processes information about the student (his/her learning progress, problem solving behavior, psychological characteristics, learning style, etc.) and of a student model that stores this information. Additionally to the mentioned components, the student diagnosis module and the student model, the ITS architecture includes (Anohina & Intenberga, 2008):

- A pedagogical module that is responsible for implementation of the tutoring process and a pedagogical model storing tutoring model and strategies;
- An expert module or problem domain module that is able to generate and solve problems in the problem domain and an expert model storing knowledge what must be taught to the student;
- A communication module managing interaction among the system and the student through different devices.

The ITS architecture and interaction between system's components is represented in Figure 1.

The field of ITSs inherited ideas from such learning theories as cognitivism and constructivism. Therefore, long years attention was focused more on student's cognitive processes. However, research in the field of ITSs in recent years has gradually shifted its emphasis from cognitive processes to emotion-

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